DOCUMENT RESUME

ED 440 070 SP 039 110

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TITLE Collaborations between the College of Arts and Sciences and the College of Education at Clarion University of Pennsylvania.
PUB DATE 2000-02-27
NOTE 7p.; Paper presented at the Annual Meeting of the American Association of Colleges for Teacher Education (52nd, Chicago, IL, February 26-29, 2000).
PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS College Faculty; College School Cooperation; Computer Literacy; *Computer Uses in Education; Cooperating Teachers; *Educational Technology; Elementary Secondary Education; *Experiential Learning; Faculty Development; Higher Education; Inservice Teacher Education; *Interdisciplinary Approach; Mathematics Education; Partnerships in Education; Preservice Teacher Education; Science Education; Teacher Improvement; Teachers; Teaching Methods
IDENTIFIERS Clarion University of Pennsylvania; Learning Communities

ABSTRACT

This paper describes TACCOL (Technology Advancing a Continuous Community of Learners), a project at Clarion University of Pennsylvania. Designed to incorporate technology into teacher education, it involves collaboration between the College of Arts and Science and the College of Education and Human Services. TACCOL infuses technology into teacher preparation by integrating technology with an interdisciplinary approach to teaching science and mathematics. It involves university faculty and inservice and preservice mathematics and science teachers. The basic technologies incorporated are laptop computers, graphing calculators, calculator-based rangers, and calculator-based laboratories. Learners are engaged with hands-on, activity-based learning opportunities. Technology competencies gained support effective teaching of the Pennsylvania Academic Standards for Mathematics and the emerging Pennsylvania Academic Standards for Science and Technology for grades K-12. The workshops help develop a community of learners. University faculty are taught first. They then teach inservice teachers during summer workshops. University faculty also teach integrated mathematics and science concepts to undergraduate preservice teachers. Undergraduates who recently began their student teaching experiences are matched with cooperating teachers who have attended the TACCOL summer workshops. The collaboration of cooperating teachers with preservice teachers completes the cycle of a continuous learning community. (SM)

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ED 440 070

Collaborations

Between the College of Arts and Sciences and The College of Education

at

Clarion University of Pennsylvania

Presented to

The American Association of College Teacher Educators Conference

Chicago, Illinois

February 27, 2000

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Collaborations
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The TACCOL project, Technology Advancing A Continuous Community of Learners, at Clarion University of Pennsylvania involves a collaboration between the College of Arts and Sciences and the College of Education and Human Services. From the inception of the idea to incorporate technology into teacher education preparation, the Dean of Education and Human Services, a representative of the College of Arts and Sciences, and a representative from the College of Education worked together closely to actualize the project.

The purpose of TACCOL is to infuse technology into teacher preparation by integrating technology with an interdisciplinary approach to teaching science and mathematics. Funding for the project is through a $455,500.00 grant from the Pennsylvania Department of Education Link-to-Learn Higher Education Initiative "Integrating Technology into Teacher Preparation" and Clarion University. TACCOL involves three distinct populations: (1) university faculty, (2) in-service mathematics and science teachers, and (3) pre-service mathematics and science teachers. The basic technologies incorporated into the project are: (1) laptop computers, (2) graphing calculators (TI-73's for elementary participants and TI-89's for secondary participants), (3) Calculator Based Rangers (CBRs), and (4) Calculator Based Laboratories (CBLs) with multiple probes. The constructivist philosophy of engaging learners with hands-on activity based projects is emphasized in the implementation of the workshops for all three populations.

Technology Competencies

The technology competencies gained as a result of this project include:

- using word processing, spreadsheet, and database software and the appropriate hardware as tools for enhancing personal productivity and for teaching mathematics and science content.
- increasing content knowledge in mathematics and science
- gathering data from the Internet to enhance instruction
- creating interactive instructional modules using PowerPoint
- using telecommunication systems to receive and send email messages, create listservs, and utilize the Internet as an instructional resource.
- integrating Calculator Based Laboratories (CBLs), Calculator Based Rangers (CBRs), probes, TI-89 and TI-73 graphing calculators into mathematics and science instruction.

These competencies support effective teaching of the Pennsylvania Academic Standards for Mathematics and the emerging Pennsylvania Academic Standards for Science and Technology for grades K - 12.

The Reform Pedagogy

All changes have ramifications and the introduction of technology into teacher preparation is no exception. Fortunately, the reform pedagogy that is used to change teaching practices closely follows the ten Teaching Principles of Quantitative Literacy (American Statistical Association, 1991). Faculty from the Department of Education in the College of Education and Human Services collaborate with faculty from the Departments of Physics and Mathematics in the College of Arts and Sciences to develop the workshops. Blending the expertise proves highly effective.

The traditional lecture format is not used during the TACCOL workshops at Clarion

University; instead, activity-based learning opportunities are incorporated into the learning process. During the workshops, students employ the four different types of technology to gather data about questions and issues that are of interest to them. Participants gather real data while conducting their scientific experiments. Their hands-on experiences with the data is observed to provide them a feeling of ownership of the data, and seems to further their interest in the analysis of the data. Although data collection is an underlying theme of the workshop, traditional topics in statistics are deliberately not taught until the participants have first gained experience in working with simple counting and graphing techniques. This delay allows the participants to develop a foundation prior to the introduction of advanced topics such as correlation and presenting data with a mathematical model. One of the activities that reinforces the theory of probability involves tossing 200 pennies, and counting the number of heads. After the heads (coins) are removed, the remaining coins are tossed a second time. The participants again count and then remove the heads. This process continues until all the coins have been removed. After recording the results of this simple experiment and discussing the results, the teachers should understand the link between the fundamental theory of probability and the mathematical model of a decreasing exponential curve.

Throughout the workshop, emphasis is placed continually on the use of good examples and intuition, rather than on probability paradoxes and the use of statistics that deceive. Each separate group is encouraged to develop a different approach to solve a given problem. Since both graphing calculators and the laptop computers are readily available for their use, participants have a choice when selecting their approach. Next, the groups analyze and evaluate the different methods that they have used with the technology. In the penny toss experiment, for example, a mathematical model is graphed on the TI-73 calculator, the TI-89 calculator, and by using the

Graphical Analysis software on the laptop computer. The emphasis for all activities is for the students to appreciate the analysis and the communication of that analysis, rather than on merely obtaining a single answer.

The in-service teachers are involved in classroom projects during the summer workshop and then again during two follow-up sessions that are held during the fall semester. Each in-service teacher is expected to implement, in their respective classroom, a project that incorporates one of the technologies that they learned at the summer TACCOL experience. Standard concepts, such as measurement, help form interdisciplinary links between mathematics and science for the participants.

The progression of the learning begins with a concrete experience, moves to a pictorial representation involving graphs and charts, and then ends with the formation of an applicable abstract concept. In the previous example, the concrete experience was the tossing of the pennies and the counting of the heads. The pictorial representation was the presentation of the data in a chart, with the trial number as the x-coordinate, and the number of pennies left as the y coordinate. The abstract concept determined was that the number of heads decreased by approximately one half each time. This resulted in a discussion of the mathematical model that the probability of tossing a head is one out of two possibilities.

After all the groups complete each project, they meet for a large group discussion of the results. The different technologies of the calculators, computers, CBRs, and CBLs with the multiple probes are usually found to have been successfully employed throughout all the workshops.

Developing the Community of Learners

The series of workshops begins with instructing the university faculty members. Members

of the Departments of Education, Mathematics, and Physics become a team. The university faculty then teaches the in-service teachers during the summer workshops. Additionally, the university faculty teach the integrated mathematics and science concepts to the undergraduate pre-service teachers during their mathematics and science methods classes. Members of the Departments of Biology and Chemistry are also involved with the undergraduate students. As one of the Project Directors, I personally taught both the teachers during the summer workshop and the undergraduate students in their mathematics methods course. As a supervisor for the secondary mathematics student teachers, I am presently observing and serving as a mentor to the preservice secondary mathematics teachers during their student teaching experiences.

Notably, the undergraduates who recently began their student teaching experiences, are matched with cooperating teachers who have already attended the TACCOL summer workshops. The collaboration of the cooperating teachers with the pre-service teachers completes the cycle of a continuous community of learners. Some of the other university supervisors are also involved in the TACCOL project, so all three populations have the opportunity to continue to collaborate with each other. Hopefully, this cycle will be continued by using the same cooperating teachers again with the new student teachers in subsequent years. The community of learners is growing and will continue to grow with the continued collaboration of the School of Education and the School of Arts and Sciences at Clarion University of Pennsylvania.

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